

liable are fully described and not generally known in this country.

The complete absence of bibliographic references is a notable defect in the volumes, more especially as they are mainly compilations of the works of other writers and investigators, whose names appear frequently in the authors' pages. In fact the reader, who might wish to consult the original works, will have great difficulty in knowing where to look for them. We are always glad, however, to welcome any contribution to a literature which is so meagrely represented in our own country.

W. G. M.

PLANTS OF THE PAST.

Éléments de Paléobotanique. By R. Zeiller. Pp. 421. (Paris: Carré and Naud, 1900.)

SOME of the most striking advances in botanical science during the last two or three decades have been in the domain of Palæobotany. The study of fossil plants is now generally recognised as a science of primary importance, which affords, not merely useful data for the stratigraphical geologist, but furnishes valuable information as to the course of plant evolution, and enables us to connect some of the phyla of the plant-kingdom at points where their common origin is clearly indicated. Prof. Zeiller, of the École des Mines, Paris, has played a prominent part in placing fossil botany on a thoroughly scientific basis; his work, which embraces a wide field, is characterised by a philosophical handling of facts, a thoroughness of treatment and a breadth of view that are too frequently lacking in scientific writings of the present day. In the book before us Prof. Zeiller has performed a difficult task with considerable success. Within a small compass he has included a systematic though necessarily brief account of the more important types of fossil plants, and concise and clearly-written chapters on various subjects of geological and botanical interest. The illustrations are well executed, and it is a pleasure to note that many of them are new. In the section treating of the preservation of plants as fossils, Zeiller draws attention to a method of examination of "impressions" which he has used with considerable success. It is often possible, after suitable chemical treatment, to examine microscopically the thin carbonaceous film, which may sometimes be detached from the surface of a plant fragment lying on a slab of shale, and in this way to obtain important information as to anatomical details.

Some interesting examples of the Siphonæ are figured and briefly described; but one or two of the examples quoted, e.g. the supposed *Caulerpa* from the Kimmeridge Clay, are of very doubtful value. The fossil Myxomycetes of Palæozoic age, described by Renault and other authors, should be mentioned with a word of caution as to their acceptance as undoubted Mycetozoa. In describing the vascular cryptogams, Zeiller notes the danger of attaching too much importance to the presence or absence of secondary wood, or to the isosporous or heterosporous character of a genus; mistakes made in the past, which have persisted for many years, emphasise the need of this caution.

In discussing the systematic position of various extinct generic types of exceptional interest which point to a common origin of cycads and ferns, Zeiller speaks of the collateral form of the vascular bundles as one of those cycadean characters which is met with also in recent ferns. It is, however, important to bear in mind the fact that in the collateral bundles of *Ophioglossum* and other ferns the protoxylem occupies an endarch position, while the cycadean type of bundle is usually mesarch.

The chapter on fossil ferns is particularly well done, and contains much that is new. The genus *Microdictyon*, mentioned by Zeiller as a mesozoic fern closely allied to *Laccopteris*, is hardly sufficiently distinct to be retained as a separate type.

The enlarged photograph of a leaflet of the well-known "fern," *Alethopteris Serlii*, given to illustrate the occurrence of what may possibly be traces of sporangia, does not afford satisfactory evidence that this fern-like frond bore fern-like sporangia. We are still in want of convincing evidence as to the nature of the reproductive organs of both *Alethopteris* and *Neuropteris*, genera in which the characters of ferns and cycads were combined.

A drawing is given of an exceptionally fine example of a rhætic fern—*Clathropteris platyphylla*—from Tonkin; as Zeiller has shown, this plant may be compared with the recent genus *Dipteris*, which, like *Matonia pectinata*, represents a tropical survival of a widely-spread mesozoic family of ferns. The inclusion of the genus *Sagenopteris* with the Hydropterideæ, rather than with the Filices, is perhaps a little rash, as the evidence so far available as to the reproductive organs is by no means conclusive.

A good description is given of the genus *Sphenophyllum*, but it is to be regretted that exigencies of space prevent full justice being done in this and other cases to the account of anatomical features. Zeiller discusses the possibility of *Sphenophyllum* having lived as a water-plant in the Coal period forests, but it is perhaps more probable that its long and slender stems were supported, like lianas, by the boughs of stouter trees.

In dealing with the Calamariæ, Zeiller does full justice to the work of English authors, and discusses controversial points with admirable judgment and an open mind. The genus *Sigillaria* is described as a true lycopodiaceous plant, agreeing in certain respects with *Isoetes*.

In the account of fossil cycads, Zeiller, like other authors, quotes an example of a cretaceous *Cycas* carophyll, figured by Heer, from Greenland; the figured specimen, which the writer has seen in the Copenhagen Museum, is not sufficiently well preserved to be determined with certainty, and bears but a distant resemblance to Heer's figure. The genus *Podozamites*, placed by Zeiller among the Cycads, may possibly be more correctly included in the Coniferæ, but it is a type of somewhat doubtful position. The flowers of *Zamites gigas*, usually known as *Williamsonia*, mentioned in the section dealing with the Bennettiteæ, are usually of Inferior Oolite rather than Lower Lias age.

Prof. Zeiller gives a useful summary illustrating our knowledge of fossil angiosperms; as he points out, the literature on Tertiary plants is in urgent need of revision

at the hands of experienced systematists. The concluding chapter, dealing with the bearing of palæobotanical evidence on plant evolution, is full of interest, and particularly valuable as being written by one who possesses both a wide knowledge of the available data and the power of critically weighing the evidence. Referring to the comparative study of species of fossil plants, Zeiller writes:

“Les Espèces, comme les genres, se succèdent par voie de substitution et non par voie de transformation graduelle, et il en paraît être de même à tous les niveaux.”

A very useful bibliography of writings referred to in the text is given at the end of the volume. A. C. S.

PHOTOGRAPHY IN NATURAL COLOURS.

Lehrbuch der Photochromie (Photographie der natürlichen Farben). Von Wilhelm Zenker; neu herausgegeben von Prof. Dr. B. Schwalbe. Pp. xiii + 157. (Braunschweig: Vieweg und Sohn, 1900)

IN 1868, after long study and repetitions of Edmond Becquerel's experiments on photochromy, Dr. Wilhelm Zenker himself printed and published a “Lehrbuch der Photochromie,” which contained a physical explanation of the colour-correctness of these photochromatic images. Zenker's book did not have a wide circulation—it would be difficult, perhaps, to name any one in England who has read it—and it was not until 1890 that Lippmann, by founding a *new* method on the principle suggested by Zenker, drew a slightly increased attention to Zenker's labours. That the attention was only slightly increased was due to two causes: firstly, the rather astonishing *results* of Lippmann and others helped to overshadow the *principle* of Zenker in the eyes of most people; secondly, among all those whose pursuits have any claim to be considered as scientific, English photographers are especially noticeable for their deliberate ignorance of the creative work of the past in photography.

For the latter reason, chiefly, the present writer has given, during the past year, a rather full analysis of Zenker's work in “Camera Obscura,” and we have now a reprint, in good *English* type, of the book. In the words of the preface, “The more modern researches on photography in natural colours have shown that the way and the explanations of modern attempts are connected in many respects with Zenker's ideas.” The volume contains besides a portrait of Zenker, a sketch of his life and index of his works by Prof. Gustav Krech; and, finally, Herr E. Tonn gives (pp. 131–157) an account of the further development of photochromy on the foundations of Zenker's theory. We shall notice these briefly in their order; but, with regard to the “Lehrbuch” itself, shall abstain from entering at all fully into the subject of its contents, as in the above-cited reference there is already a full account of it in English.

Wilhelm Zenker (1829–1899) cultivated many different branches of knowledge. His first papers (1850–1866) were zoological; the “Lehrbuch” was his first contribution to photography; and his other papers were on colour-perception (1867), photography and physical optics, astrophysics, and, in later life, meteorology. The “Lehrbuch,” however, is probably the most important of

his works, and it is to be hoped that now, with this excellent reprint, his methods will have some influence on English photography.¹

The book is divided into three parts: (1) Considerations on colours (“Das Wesen der Farben”); (2) Account of his predecessors' work in photochromy (“Die Wiedergabe der Farben”); and the third part (“Theorie der Photochromie”), after an account of the theories of Seebeck, Becquerel and others, contains Zenker's own ideas (pp. 116–129). There are one or two useful notes to this section.

Herr Tonn's section, with one exception, seems very complete, and full references are given. It is, however, a pity that the very pregnant hint of Lord Rayleigh should be unnoticed (*Phil. Mag.*, 1887). Lord Rayleigh, independently of Zenker, and starting from totally different considerations, indicated in a footnote the Zenker principle, and even went farther; for not only did he seek to *explain* the results of Becquerel by this principle, but seemed to see the possibility of a *new* method of photochromy based on it. It would be interesting to have some account of Lord Rayleigh's then promised experimental investigations. If Herr Tonn knew this paper, it is difficult to understand how he resisted the temptation of comparing Rayleigh and Zenker—Zenker who was so clearly a non-mathematician.

The chief value of the book, the writer persists in believing, is not historical—for it *has* not had very much influence in the moulding of thought—but is in its spirit; the influence of its point of view and methods is needed above all at the present time for English photographers; this does not mean, of course, the small number of English *photo-chemists*.

PHILIP E. B. JOURDAIN.

OUR BOOK SHELF.

Die Harze und die Harzbehälter. By A. Tschirch. Pp. viii + 417. (Leipzig: Gebrüder Borntraeger, 1900.)

THE author has spent eight years in collecting and arranging the scattered facts relating to the obscure group of organic compounds which are classified as resins by virtue of a common physical characteristic.

What Kekulé termed “the chemical lumber room” contained at one time a collection of similar obscure groups, such as the alcaloids, colouring matters, tannins, aromatic compounds, &c.; but since the year when that chemist gave to the world his benzene formula, the lumber room has been industriously ransacked and its contents dragged forth into the light of day. Perhaps the resins have received the scantiest share of attention; partly, no doubt, owing to the practical difficulties which they offer to the chemist.

We know nothing of the molecular state which finds its physical expression in these amorphous, translucent compounds, nor how to bring them into a condition of ascertained purity. How often does a promising research miscarry by the unwelcome appearance of resinous products! Nevertheless the mass of research which has accumulated on the subject fills 400 closely printed pages.

A great amount of this research gives very little indication of the nature of the resins themselves. The older chemists distilled them and obtained products such

¹ His work for the Paris Academy prize in 1868 stands in close relation to his theory of photochromy (see Fizeau's report, *Compt. rend.*, lvi., lxvii.). Zenker's memoir was never published, and Otto Wiener (*Wied. Ann.*, 1890, 1895) later and independently followed the same train of thought. (Cf. also Cornu, Poincaré, Potier and Berthelot, *Compt. rend.*, cxii.; and Drude, *Wied. Ann.*, xli., xliii.)